

XXII. *Proceedings relative to the Accident by Lightning at Heckingham.*

LETTER FROM THE BOARD OF ORDNANCE.

S I R,

HAVING received information that, last summer, a stroke of lightning set fire to the Poor-house at Heckingham, near Norwich, notwithstanding it was armed with *eight pointed conductors*, we request you will communicate to us such particulars relating to that fact, as may have come to your knowledge.

We are, with great respect,

S I R,

Your most obedient humble servants,

AMHERST.

CHARLES FREDERICK.

H. STRACHEY.

J. KENRICK.

Office of Ordnance,
22d December, 1781.

Sir Jos. Banks, Bart. President of the Royal Society.

Extracts from the Minutes of the Council of the Royal Society.

January 10, 1782.

THE President laid before the Council a letter to him from the Board of Ordnance, acquainting him, that the Poor-house at Heckingham, near Norwich, had been struck by lightning, notwithstanding it was armed with eight pointed conductors; and requesting him to communicate to them such particulars relating to that fact as may have come to his knowledge.

Resolved,

That Dr. Blagden and Mr. Nairne be requested to repair to Heckingham, and examine into the circumstances of the accident, and report thereon to the Council: that they engage a draughtsman, to take such drawings as may be requisite; and that the necessary expences be defrayed by the Society.

February 7, 1782.

Dr. Blagden read to the Council his and Mr. Nairne's Report of the Survey made by them of the Poor-house at Heckingham in Norfolk, in consequence of their appointment by a former Council. The said Report was ordered to be read to the Society on Thursday the 14th instant. And the President was requested to transmit it immediately afterwards to the Board of Ordnance; and to desire that they would return the drawings as soon as they should have taken copies of them, or made such other use of them as they might think necessary.

Report

Report of the Committee.

Read February 14, 1782.

To the President and Council of the Royal Society.

GENTLEMEN,

PURSUANT to your resolution, appointing us a committee to examine the House of Industry at Heckingham in Norfolk, which had been struck by lightning although it was armed with conductors, we arrived there on the 21st of January. Seven months had then elapsed since the accident, yet we had the satisfaction to learn, that no material changes had been made in the conductors or the building in that period; some laths that had been burnt, some bricks and pantiles which had been damaged or thrown down, were replaced; but we found means to procure distinct information of those repairs from the workmen who had been employed to execute them. In order to communicate a clear idea of the accident, it will be necessary to premise a general account of the building; then to represent the manner in which the conductors were applied; and, lastly, to describe the stroke of lightning, with its effects.

The general form of the building is that of the Roman letter H (see the general plan, fig. 1.), consisting of a center range (Z) and two flanks (Y and X). It stands on a gentle rising, which can by no means be termed a hill, with its front facing S. 9° W. To the western side of the west flank, and eastern side of the east flank, some lower buildings are annexed, serving as offices of different kinds; and there are two courts, one before and the other behind the house, together with some small gardens and yards on each of the flanks, in all of which stand various detached offices, as will be easily conceived from the general plan (fig. 1.).

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The body of the building, including the great house with its annexed offices, is provided with eight chimnies, the position of which is represented in the plan (fig. 1.) at the letters A, B, C, D, E, F, G, H. Of these the six first are all placed on the ridges of the roof; namely, A and B on the ridge of the west flank, C and D on the ridge of the center range, and E and F on the ridge of the east flank; but the chimney G rises from the lower part of the roof on the eastern side of the east flank; and the chimney H from the roof of an annexed office, the boiling-room, which roof is continued down from the general roof, and projects beyond it.

Both flanks (X and Y, fig. 1.) at their north and south ends are hipped off from the ridge of the roof to the eaves on each side; consequently there are eight hips, all of which are covered or *coped* with lead; the four vallies also, formed by the intersection of the center range with the two flanks (see fig. 1.) are in like manner covered with lead, which here answers the purpose of a spout. (Two of these hips are shewn in the 2d, 3d, 4th, and 11th figures at *b*, *b*, and one of the vallies at *v*, fig. 2.) Those twelve strips of lead, covering the hips and the vallies (see the general plan, fig. 1.), are all separate, not having any metalline communication with one another, as the rest of the roof consists merely of pantiles, with dropping eaves.

From the south-east corner of the east flank a wall is continued eastward (see I in the 1st and 3d figures) above 26 feet in length, having a small garden at its south side, and on the north a stable built against it as a *lean-to* (K in the 1st and 4th figures); which stable is also supported on the west by the east wall of the east flank of the building (fig. 1. at *t*). The roof of the stable being like that of a shed, slopes downward from south to north (*a* and *b* in the 4th and 11th figures); it does not reach up quite

quite to the top of the wall against which it rests to the fourthward, but is shorter by one course of bricks on edge (see fig. 10. and 11. at *c*); and at its junction with the wall a *flashing* of lead is carried along horizontally (from *c* to *d*, fig. 11.) $25\frac{1}{2}$ feet in length.

We conclude this general account of the building with the dimensions of its principal parts.

	Ft.	In.
Length of the center range (Z fig. 1.) to the flanks - - - -	108	9
Length of each flank (X and Y fig. 1.) - -	159	7
Breadth of the center range, and of each flank,	31	4
Height from the ground to the bottom of the hips (g, g, fig. 3. and 4.) - - - about	20	6
Height from the ground to the top of the ridge (f, fig. 2. and 3. e, fig. 4) - - - about	34	0
Height of the chimnies above the ridge of the roof (as E, fig. 4.) - - - about	3	6
Length of each hip (from f to g, fig. 3. 4. and 11.) - - - - about	27	0
Height of the wall (I) supporting the stable (fig. 3.)	16	0
Height of the eaves of the stable above the garden to the northward of it (see general plan, fig. 1.)	7	0
Length of the stable on the outside - -	26	2
Breadth of the stable on the outside - -	15	5

To all the eight chimnies which have been described we found iron rods affixed, reaching between four and five feet above the top of the chimney, pointed at the upper end, and tapering about ten inches to that point. Each rod or bar was nearly square, measuring, upon a mean, about half an inch one way, and four-tenths of an inch the other, with the angles

just rounded off. These conductors were continued down the building by a succession of similar bars of iron, in general from six to eight feet long, joined to one another by two hooks and nuts (see fig. 12.); that is, the corresponding ends of each bar being formed into a hook bent at right-angles, the hook of the uppermost went into a hole of the lowermost, where it was fastened with a nut, and the hook of the lowermost went into a similar hole of the bar above, where it was fixed in the same manner; the length of each of these joints, from nut to nut, was about two inches.

Though there were eight of these conductors reaching above the chimnies, yet they had only four terminations below. For the conductors to the two chimnies D and E (fig. 1. and 2.) being continued toward each other along the roof, united in the valley over the lead gutter there (at L in the 1st, 2d, and 3d figures), and from that point only one conductor was continued down the valley toward the ground. In like manner the two conductors from the chimnies A and C (fig. 1.) united in the valley of the roof between them, and were carried down toward the ground as a single rod. All the three conductors from the chimnies F, G, and H, successively joined together (see M, N, fig. 1.), and only a single rod was continued from them down the lower part of the building. Lastly, the conductor from the chimney B (fig. 1.) went down single all the way, without having formed a junction with any other.

As the conductors, therefore, in their passage down the building, were thus reduced to four, we are now to shew their four terminations. And, first, that from the chimney B, being the simplest, was carried down the western side of the west flank, till it came very near the ground, when it entered a small channel of brick-work, through which it was continued under the pavement into a narrow bricked drain, leading through

through the wall of a privy (at O, fig. 1.) into which the drain discharges itself. The conductor having passed, in the drain, through the hole in the privy wall, was continued about three feet into the open space under the seat of the privy, where it terminated in air, none of the solid work being nearer its end than six inches. As this drain is constructed to receive the foul water from the yard, and one of the water-cocks is near, some moisture will most commonly be found in it; but the stones slope so rapidly at the termination of the drain in the privy, that any water which runs thither must be immediately carried off. This conductor, as well as all the others, was kept in its place near the wall in its passage down, by ring-staples driven into the wall.

The second termination we shall describe is that belonging to the chimnies F, G, H (fig. 1.). The conductor from the chimney F in passing down the roof was joined by that from the chimney G (at M, fig. 1.) and afterwards by the rod from the chimney H (at N, fig. 1.); thence the iron was continued down till it came near the bottom of the wall, where it was turned off along the pavement toward a sink (fig. 1. Q) not quite two feet distant, through the side of which it was carried, and projecting four inches into the open space of the sink, there terminated in air. The sink is built of brick, one foot nine inches deep, and two feet and a half square within; and into its south side is fitted an iron grate, of the same length as the side externally, and about seven inches deep, the lower part of which lies on the bare soil. Through the middle of this grate the conductor passes, resting in contact with one of the bars. From its termination to the bottom of the sink is not less than twelve inches; and the bottom, which is of brick, slopes so much, that water can never lie upon it, there being a large

drain on the further side, which leads off from the bottom of the sink.

The third termination to be investigated is that formed by the conductors from the chimnies A and C (fig. 1.). These, after joining in the valley which lies between them, ran down, as a single rod, over the lead covering the valley, passed through a hole in that lead, where it projects over as a spout, and descended in the angle formed by the intersection of the west flank with the front of the center range (S, fig. 1.). Being arrived within eight inches of the ground, it entered a narrow channel of brick-work, through which it was conveyed into a small close drain or gutter, where it terminated, with a hooked end, in contact with one of the side bricks. It touched nothing solid, therefore, in its course under the ground, but brick-work. The small drain in which it terminated was so placed as not to receive much moisture; and this drain led into the side of a grated sink (U, fig. 1.), at the bottom of which the great drain of the fore-court begins.

Of the several conductors that have been hitherto considered, the different parts of the building to which they were affixed, and their respective terminations, very accurate drawings were made on the spot; but as these conductors were more distant from the stricken end of the house than those which remain to be described, and also shewed no marks of having been affected by the storm, we thought it unnecessary to enter into a more circumstantial detail regarding them; especially as, if any further particulars should appear hereafter to be of consequence, it will at all times be easy to refer to the original drawings and notes.

We proceed now to examine the fourth termination, by which the conductors from the chimnies D and E (see fig. 1. and

and 2.), being those nearest the stricken corner, were carried under the ground. The conductor of the chimney D, from its upper point to its final termination, consisted of ten bars, into the sixth of which the conductor coming from the chimney E was fastened by its fourth bar, reckoning from the top (at L, fig. 1. and 2.). This junction was made by a hook at the lower end of that fourth bar of the conductor from the chimney E, which hook was received into a hole of the above-mentioned sixth bar, and fixed there by a nut underneath. Here was, therefore, only one hook and nut, instead of two as in the common joints. Also at the top of this sixth bar of the conductor from the chimney E, where it united with the fifth bar, only one hook and nut were employed to form the junction, the other hook appearing never to have been put into its corresponding hole. In this same sixth bar, above the hole into which the conductor from the chimney E was inserted, we found four other spare holes, which were left quite empty.

Tracing the conductor downward from this point of union, we found it descend over the lead of the valley, to the surface of which it gradually approached, till at a hole made on purpose (*m*, fig. 2.) it passed through the lead, whence it was continued down the angle formed by the intersection of the east flank with the front of the center range (T, fig. 1. 2. and 5.). It no where touched the wall of the building, but was kept in its place by ring-staples (*p*, *p*, fig. 3.). Being arrived within two or three inches of the ground, it entered into a channel of brick, enclosed on all sides (at *e*, fig. 5.), in which it was continued down to the arch of the great drain of the fore-court (*x*, fig. 5.); here, having passed through a hole in the haunch of the arch (*y*, fig. 5. and 7.), it was bent off from the house through the middle of the drain, and

ultimately terminated in contact with the bricks at the bottom of it (at *z*, fig. 5. and 7.). This conductor, therefore, in its passage downward, did not communicate, till it reached the bottom of the drain, with any thing better able to carry off electricity than masonry or timber; for the iron-staples fastening it to the wall, and the lead lining the valley, were themselves in contact with such substances only.

As this drain, then, is the real termination of the conductor, it must now be more attentively considered. It begins at the western sink of the fore-court U (fig. 1.); thence it is continued (V, V, fig. 1.) with a proper declivity to the eastern sink W (fig. 1. 5. and 6.); it then runs under the east flank of the house (V2, fig. 1. and 5.), and ends beyond it in the side of the cefs-pool P (fig. 1.). From the grating on the sink U to that on the sink W (fig. 1.) is 89 feet, and thence to the cefs-pool P near 69 feet; the breadth of the drain at bottom (*z*, fig. 7.) is 14 inches; its height to the spring of the arch (fig. 7.) 16 inches, and to the crown of the arch (*x*, fig. 5. and 7.) 23 inches. When we saw it, the moist filth, or sludge, at bottom (*z*, fig. 7.) was two or three inches deep; but when the court is overflowed, as the two grates (at U and W, fig. 1.) are laid on purpose to receive the superfluous moisture, there must be some run of water through it. We estimated the fall of the drain, from the eastern sink W (fig. 1.) to its termination in the cefs-pool P, at two feet. The cefs-pool itself resembles a well, walled round in the inside, and has foul water stagnating at the bottom, which cannot rise above a certain height on account of a large drain, leading from it into the great reservoir (at R, fig. 1.), out of which the foul water is ultimately pumped. When we examined this cefs-pool, the water in it stood even with the bottom of that great drain, consequently was almost

as

as high as it could be, unless the drains should at any time be flooded; and upon measuring the distance from the bottom of the drain coming from the fore-court (V2, fig. 1.) where it terminated in the side of the cefs-pool, down to the surface of the water stagnating in the cefs-pool, we found it $3\frac{1}{2}$ feet. This interval, therefore, of three feet and a half must be passed through, to form a communication between the water in the drain, and that in the cefs-pool. The drain is firmly built of brick and mortar (see the section of it, fig. 7.). To determine the nature of the soil in which it is laid, a hole was dug in the fore-court seven feet deep, where we found nothing but sand, at this time pretty moist, with a few pebbles. There is reason to believe, however, from the soil of an adjacent declivity to the northward, that below the sand, perhaps at the depth of 15 or 16 feet, a bed of clay would be found.

Against the east flank, near the corner T (fig. 1.), there rises a leaden pipe with a cock (O, fig. 2.), to which the water is conveyed from a raised cistern (see r, fig. 1.) in one of the detached offices of the back-court. A main of lead from the cistern, which is itself of that metal, after sending out pipes to some other cocks, and passing through the cellars of the house, comes into the fore-court about four yards from the corner T (fig. 1.) and is carried over the drain at the distance of about a foot above its crown, and eight inches below the surface of the ground. Here it divides into two branches, one of which goes straight to the cock at O (fig. 2.), and the other runs westward, to supply a similar cock in the opposite corner. We measured the distance of these pipes and cocks from the conductors, and found that they came no where nearer than five feet and an half.

Such

Such were the conductors that, in the month of June, 1777, several years after the House of Industry had been built, were erected with the hope of guarding it from lightning. The iron of which they were formed had in that time acquired a coat of rust, such as might be expected from four years exposure to the air. On the 17th of June, 1781, after a showery forenoon, a heavy cloud having risen from the S. W. brought on a severe thunder-storm, attended with such heavy hail and rain, that the court before the house was overflowed. At length, about three in the afternoon, when this storm had already lasted 15 or 20 minutes, a single and very loud explosion was heard, like the report of a cannon, which exceedingly terrified all the people in the house, and affected three of the paupers so much that they fainted. At the same time a great light was perceived, which seemed, as they expressed it, to come in at the windows; and still more at the doors of the rooms, like a sheet of fire. Within one or two minutes, the south-east corner of the east flank of the building was observed to be on fire, the flame bursting out at the bottom of the hip (see *g* in fig. 3. 4. and 11.). By the brisk exertions of the people in the house, this fire was quickly extinguished; and the court was so overflowed, that they procured sufficient water for that purpose by means of a hole which they dug near the burning corner of the building. The storm, and especially the rain, continued some time after the stroke, but not with such violence as before. At the moment of the explosion it was nearly calm; but the wind had been south-westerly all day, and the sky was observed to be clearing in that quarter about the time of the accident.

To come at the fire, in order to extinguish it, the lead had been rolled off the bottom of the hip, and some bricks thrown down, all of which were replaced when we arrived at Heckingham;

ham ; but as the men, who had gone up to the corner of the house on the first appearance of the fire, seemed to recollect very well the state in which they had found the lead and tiles at that moment, they were desired to put every thing in the same state to the best of their memory. With this view they turned back the lead at the bottom of the hip on its south side, so that the south-west face of the hip-pole might be seen, and threw down a few tiles, after setting one on edge against the hip-rafter. The lightning then, if such evidence be admitted, had raised up that corner of the lead to the breadth of about six inches at the bottom, and displaced some tiles. An effect of this kind upon the lead, is one of the commonest facts observed in buildings that have been struck by lightning. It so happened, that the piece of lead which we found on the bottom of the hip at Heckingham, had upon it several impressions or pits ; concerning which various opinions were entertained, till an experiment, made since our return to town, seems to have put it beyond doubt, that they are nothing but marks of large shot, such as might have been produced by firing, with a large fowling-piece, at a bird sitting on the corner of the house. All the people who assisted in extinguishing the fire agreed, that on the eastern side of the hip, the lead remained, after the stroke, in its usual situation.

On removing entirely the lower part of the lead, no kind of damage was seen on the wood of the hip-pole, except that near the lower end it was slightly scorched in one place, apparently by the flame which had burst forth from below ; the spike-nail which had fastened the lead to it appeared perfectly sound, and even the hole made by that nail in the wood was neither burnt nor splintered. This hip-pole was supported, at its proper distance from the hip-rafter, by an iron-strap, or holdfast, which was
driven

driven into the timber making the tie of the angle, through the bevelled end of the hip-rafter, just without the part where the tenon of the latter is received into the mortise of the former (*a*, fig. 8.). Here it was that the fire seemed to have begun, though neither the holdfast itself, nor the hip-pole resting upon it, shewed any signs of the lightning. From the place into which this holdfast was driven (*a*, fig. 8.) to the outer end of the angle tie (*b*, fig. 8.) there was a considerable loss of substance, occasioning a large hole; but the sides of the hole within were so smooth, and so little charred, shewing plainly the grain of the wood, that it was scarcely possible to suppose the whole had been *burnt* out; we conjectured, therefore, that a large splinter had been forced off by the lightning at this place, and, in the same moment, the tenon of the hip-rafter set on fire where it enters the mortise. Indeed, unless some opening had been made by forcing out such a piece, it does not appear how the fire could have burnt, for want of air, in a part that is always so closely joined by builders: and yet, in this confined place, the tenon of the hip-rafter was so far consumed, that a ruler could be thrust in, almost to the further extremity of the mortise. From this spot the flame seems to have issued out eastward, between the tie of the angle and the wall-plate (*c*, *c*, fig. 8.) scorching all the timbers it could reach, and setting fire to the laths; but the mischief it had done was very trifling (see fig. 8.).

Just beneath the abovementioned hole at the end of the angle-tie (*b*, fig. 8), is the extremity of the wall-plate which lies upon the eastern wall of the east flank (*d*, fig. 8.). The end of this wall-plate was rent in a remarkable manner (*e*, *e*, *e*, *e*, fig. 8.), and several of the fissures were continued some way upon the sides (*d* and *f*, fig. 8.). Though the other timbers we have

mentioned are of fir, the wall-plate is of solid oak; and the violence done to its extremity was such, that we could not doubt but it had been occasioned by the lightning.

Under this end of the wall-plate there was a crack in the south face of the corner (*m*, fig. 8.), which went down four courses of bricks, and then terminated abruptly (*m*, fig. 3.). The three external courses of bricks above this crack were new, and projected out much farther than the others, to form the cornice of the wall. Whether the bricks of the old cornice had been damaged or thrown down by the stroke, we could not learn with certainty; but the general report among the people we consulted was, that they had not, and were only taken down to extinguish the fire: this opinion seemed probable from the want of marks on the hip-pole which projected out with the cornice, and the appearance of such strong effects of lightning on the wall-plate which lay within any part of the projection; whence it might be concluded, that the lightning passed within the cornice, and no where through it. Between the bottom of the wall-plate, and the top of the crack where it appeared to begin at the foot of the cornice (*m*, fig. 3. and 8.), lay two inner courses of bricks (*o* and *p*, fig. 8.) covered by the cornice. Some damage had evidently been done to the bricks in this part, though we could not distinctly trace the progress of the lightning through them.

Beneath the east edge of the wall-plate, and separated from it in like manner by two courses of bricks, a similar crack descended from the bottom of the cornice (*l*, fig. 4. and 8.) on the east face of the corner, and went through ten courses of bricks till it reached the top of the wall that supported the stable. Here the three bricks next the house, it is said, were shivered into pieces as small as nuts, but not thrown off (*c*, fig. 10. and 11.). The cracks in the bricks on both faces of the

corner remained, having only been filled up with mortar; but new bricks were put in the place of the three that had been broken on the wall. All the workmen we saw agreed in opinion, that no iron cramps, or other metal, had been used in the brick-work.

Beginning from these three shivered bricks on the top of the wall, three courses of pantiles on the roof of the stable, in the direction downward, were in great measure broken or displaced, except about two feet of the lower end of the courses, near the eaves, where the tiles remained untouched (see *c, m, g, q*, fig. 10. and *c, q*, fig. 11.). All these pantiles rested upon laths, which were fastened to the rafters of the roof by iron nails about eleven inches asunder. Within the stable, and almost underneath the spot where the damage to the pantiles ceased, a saddle hung, at the time of the accident, by a nail driven into the wall at that west end of the stable, which was also the eastern wall of the east flank of the house (*n*, fig. 10.). As this saddle, being much torn by the lightning, seems to have been the step by which it passed through the stable, the respective situations of all their parts shall be minutely described.

The stable in its inside is 25 feet long (from *r* to *s*, fig. 9.), 13 feet broad (from *t* to *u*, fig. 9.), 15½ feet high on its south side (from *w* to *x*, fig. 10.), and 7½ feet on the north (from *y* to *z*, fig. 10.). At the west end is a stall for one horse (*s*, fig. 9.). Near the middle of the north wall is a drain (*y*, fig. 9. and 10.), which terminates just without the wall in the garden (*k*, fig. 9. and 10.). Against the west end of the stable, a shelf (*e, f*, fig. 10.) was supported by two nails underneath (*f*, fig. 10.). Seven inches and a half below this shelf was a nail, on which the saddle hung by one of its stirrups (*n*, fig. 10.). The breadth of the shelf was near one foot and an half; its length

length (from *e* to *f*, fig. 10.) two feet five inches; and the pantiles seem to have been displaced a little farther down on the roof (*g*, fig. 10.) than the line corresponding perpendicularly with the north end of the shelf (*b*, fig. 10.). Neither the shelf, nor the nails supporting it, which were both near its north end, shewed any signs of injury; whence it may be conjectured, that if the lightning took its course this way, it passed obliquely between the saddle and the roof, so as to miss the edge of the shelf, leaving it to the southward. The upper part of the south side of the stable was boarded off from the rest, to form a hay-chamber, which occupied so large a portion of the roof (from *x* to *m*, fig. 10.), that the boards of the perpendicular partition (at *o*, fig. 10.) came within ten inches of the nail on which the saddle hung. These boards were fastened to the uprights of the partition, all the way down from the roof, by nails about six inches asunder, consequently some of those nails must have been within ten inches of the stirrup-iron as it hung on the nail in the wall (*o* and *n*, fig. 10.). No tokens of the lightning could be discovered on those boards, or the nails fastening them; we could not, therefore, be certain, whether any part of it had passed that way. The nail which supported the saddle was equally free from marks; but one of the stirrup-leathers was much torn and burnt, and a large piece of the leather was stripped off the seat of the saddle, besides other damage done to it in that part. One of the stirrup-irons, likewise, exhibits some appearances of fusion on the arch through which the stirrup-leather passes. This iron, as well as the stirrup-leather, being the only damaged parts of the saddle that remained, we have brought for your inspection.

It must be evident that we derived the knowledge of most of these circumstances relative to the effects of the lightning upon and within the stable from information, the damages having

been repaired before our arrival. As the workmen present, however, agreed pretty well in their testimony, and it was corroborated by every thing that appeared, we desired them to replace all the parts as they were left by the accident, and thence made the descriptions and drawings. We gave directions that a man, accustomed to the stable, should hang up the saddle there in the usual manner, and then ascertained the following measures :

	Ft.	In.
From the nails supporting the shelf in the stable (at <i>f</i> , fig. 10.) to the nearest nails of the pantile laths of the roof (about <i>b</i> , fig. 10.)	1	3
From the south end of the shelf (<i>e</i> , fig. 10.) to the roof over it (<i>m</i> , fig. 10.)	2	1
N. B. The south end of the shelf was fixed to the partition-boards of the hay-chamber (<i>e</i> , fig. 10), and the two nails under its north side (<i>f</i> , fig. 10.) were $5\frac{1}{2}$ inches apart.		
From the nearest of the nails supporting the north end of the shelf (<i>f</i> , fig. 10.) to the nail on which the saddle hung (<i>n</i> , fig. 10.)	0	8
Length of the stirrup-iron below the nail (<i>n</i> , fig. 10.)	0	$3\frac{1}{2}$
Length of the stirrup-leather, from the stirrup-iron to the seat of the saddle	1	9
Breadth of the seat of the saddle	0	8
Distance from the lower side of the seat, as the saddle hung, to the bottom of the lowest stirrup-iron (<i>p</i> , fig. 10.)	2	0
Distance from the lowest stirrup-iron (<i>p</i> , fig. 10.) to the floor of the stable (near <i>d</i> , fig. 10. and 9.)	3	6
	As	

As the saddle was thus placed by recollection, the girths reached from it to the ground (*d*, fig. 10. and 9.); but neither these girths, nor any other part of the saddle, except one stirrup-iron, one stirrup-leather, and the seat, were said to have been damaged by the accident.

From the quantity of rain which fell in the thunder-storm, the stable was overflowed with water, which gradually sunk into the drain (at *y*, fig. 9. and 10.). The leather stripped off the seat of the saddle was found in the stable near this drain; whether thrown there originally, or carried by the water, is uncertain. From the point of the floor immediately under the saddle, to the nearest part of the drain, was about $12\frac{1}{2}$ feet; the width of the drain (*y*, fig. 9.) 14 inches; its length through the wall to the edge of the hole or sink into which it discharges itself 18 inches, and the depth of the sink from the bottom of the drain about one foot and an half. As this sink was merely a hole, without any drain leading *from* it, and was bricked at the sides, the water could not pass off by the drain of the stable any faster than it could soak through the loose soil at the bottom of the sink. And it is evident, from this construction, that the earth under the sink will usually be some of the wettest near the building, and be impregnated with salts from the stale of the horses.

Except the marks which have been already described, we could not find on any part of the stable, either within or without, the least vestige of the lightning. We particularly examined the lead *flashing* on the top of the roof (from *c* to *d*, fig. 11.), and the hay-chamber immediately under the three broken bricks and the displaced pantiles, but in vain. There was a hook fixed in the wall, 15 inches below the nail on which the saddle hung, and so exactly underneath, that the stirrup-leather may be

be supposed to have covered it ; but this also appeared to be perfectly untouched. After making every possible inquiry, we could not determine by evidence, whether the stirrup-leather which is so fringed and torn was the upper or the lower one at the time of the accident. Much less could we get information of the respective positions of the two stirrup-irons. But, whatever their situation may have been, as so few steps were to be traced, it would seem that the lightning must have jumped over at least one long interval in its passage through the stable.

About seven feet from the stricken corner of the building, and almost two feet from the nearest part of the roof of the stable, is a window (A, fig. 4. 10. and 11.) being the southernmost of the upper range on the east face of the flank. It has thirty small panes of glass, set in lead. We were informed, that about half of these had been broken by the accident, chiefly on the side next the corner ; and that the fissures ran in general horizontally, nearly parallel. Very little, if any, of the glass was forced out. As we could not discover any trace of the lightning directly toward this window, a suspicion arose, whether it might not have been broken rather by the general concussion than by any immediate stroke.

Having examined all the marks that appeared between the bottom of the stricken hip and the ground, our next inquiries were directed to the top of the hip (*f*, fig. 2. 3. 4. and 11.). Here the upper plate of lead (*e*, fig. 4.) which served as a capping to the junction of the hip with the ridge of the roof, being taken off, we found, on its under surface, three distinct marks of fusion ; and on the upper surface of the sheet of lead which it covered three corresponding marks, so exactly similar, that the two surfaces of lead seem to have touched one another in a melted state. These fused spots are just in the bend of the
lead,

lead, answering to the obtuse angle formed between the hip and the roof (*f*, fig. 4.). We obtained leave to bring away both the pieces of lead, and now present them for your inspection. The workmen who examined the timber underneath reported, that it was not damaged; nor were any other signs of the lightning perceived in the whole length of this strip of lead from the top to the bottom of the hip. In the pieces of lead which exhibit the melted spots on one surface, the other surface is perfectly clear of all marks, though the latter was, in the uppermost plate of lead, that which had lain exposed to the clouds. Neither of them is melted to any depth into the substance of the metal.

As both extremities of the hip, therefore, were, in some degree at least, affected by the lightning, we proceeded to ascertain their distances from the nearest conductor, which was that affixed to the chimney E (fig. 2. and 4.). Having determined the necessary measures, and calculated the hypotenuse, the distance from the point of the conductor to the beginning of the lead on the top of the hip (*e*, fig. 4.) came out 42 feet and a quarter; thence to the bend where we found the marks of fusion (from *e* to *f*, fig. 4.) was five or six inches more; and as the hip measured about 27 feet in length, the distance from the conductor to the bottom of the hip (*g*, fig. 4.) may be called 69 feet. From the top or bottom of the hip, to the nearest part of the conductor as it ran downward, the distances were not a foot less than these measures. We then took down the uppermost rod of the conductor, and carefully examined it, especially at the point, and at the hook and screws by which it had been joined to the second rod; but could nowhere discover the least mark of fusion or other injury. At the bottom of this conductor, however, where, having joined that from the chimney

D, it terminated in the drain (see the general plan, fig. 1. and 2, fig. 5.), a small bright spot appeared on one of the angles. As some suspicions were entertained, whether this mark might not have been occasioned by the lightning, we cut off the end of the rod, and have brought it hither for public examination.

Where this conductor entered its channel at the corner of the court (see T, fig. 1. and e, fig. 2. and 5.), the ground is raised so much above the grate of the sink (W, fig. 1. and 5.) that, though the court was overflowed, it is not probable, the water could have risen high enough to run into the channel (at e, fig. 5.), and so communicate with the conductor before it reached the drain.

Close to the chimney E, a dinner-bell hung in a common frame (q, fig. 2. and 4.). Three different persons went up to examine this bell; but could not discover upon it any where the least vestige of the lightning.

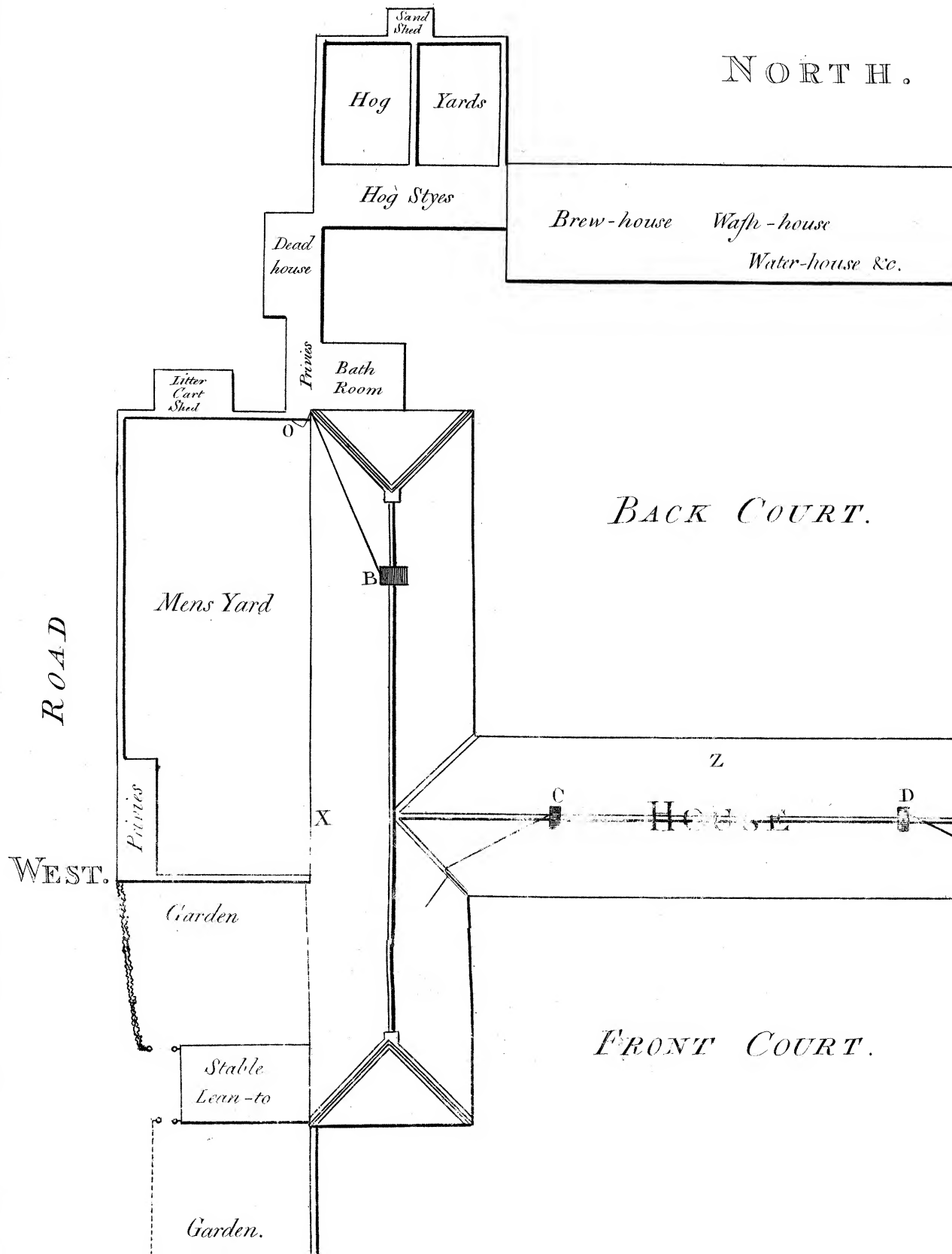
Such are the facts we were able to collect from an assiduous examination of the Poor-house at Heckingham, and of those witnesses in the neighbourhood who knew any thing of the accident. We have stated the appearances as they presented themselves to us, with all the minuteness that could be preserved without too much crowding the narrative, and independently of any opinions. Whether the earth or the clouds were positive at the time; whether the top or bottom of the hip was first affected by the stroke; whether all the lightning took its course through the hip, or part went that way, and part through the conductor; and how far the conductors were properly constructed, or adequately terminated; are questions which will naturally suggest themselves to your consideration.

It

Fig. 1.

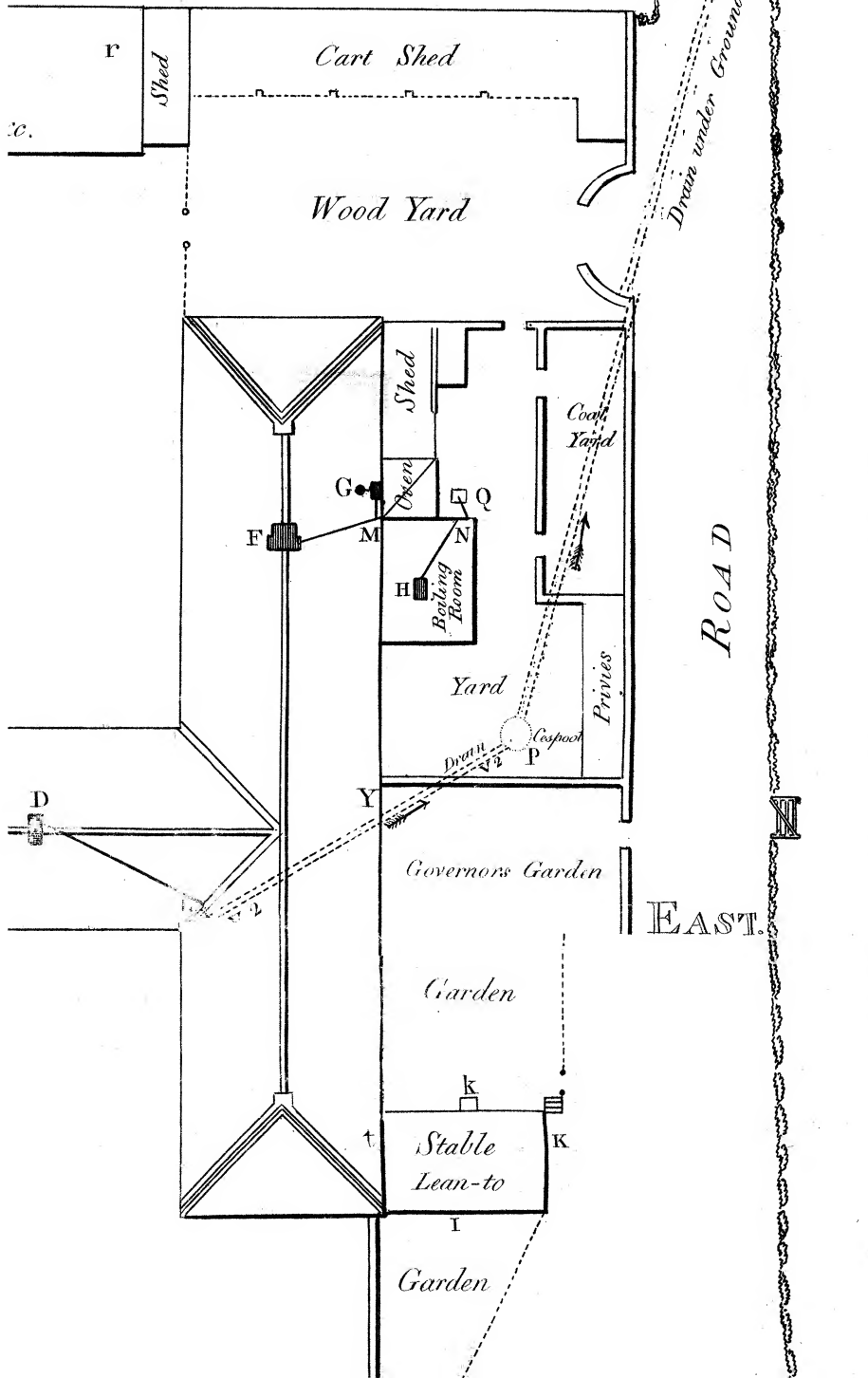
GENERAL PLAN

NORTH.



AN.

II. o.



Garden.

Lodge

Lodge

R O A D

50 40 30 20 10 0

S O U T H .

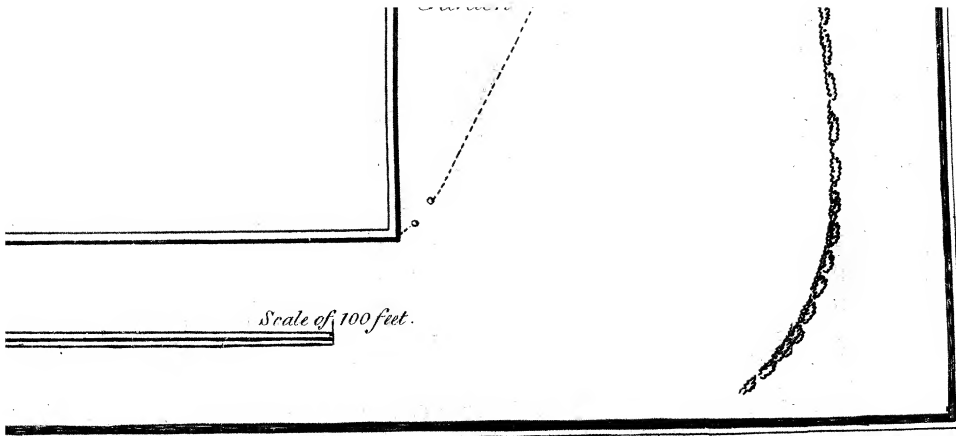
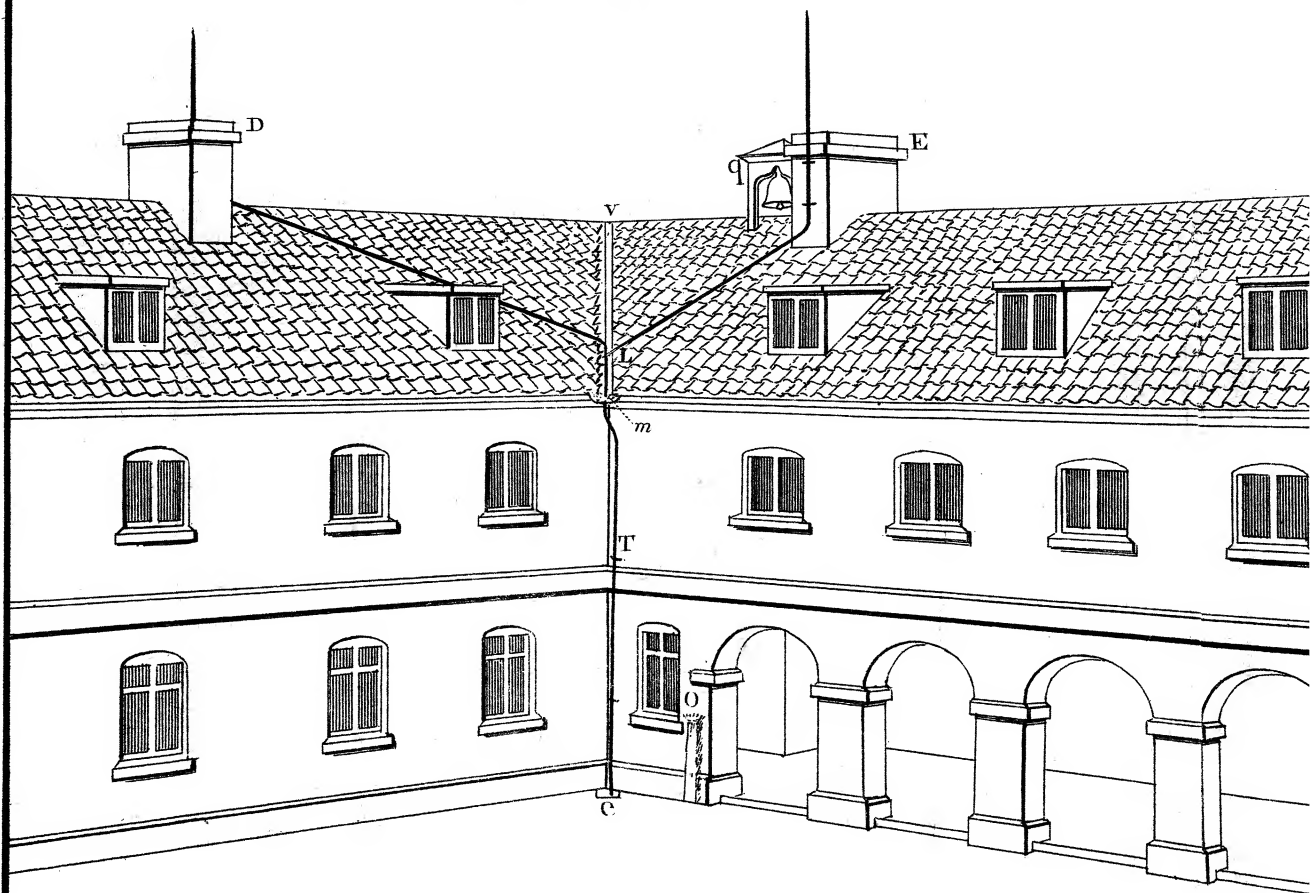


Figure 1.

Fig. II.

*SOUTH WEST VIEW of the EAST WING and
shewing the junction of the two Conductors that*



*G and part of the CENTER RANGE
s that were nearest the Stable Lean-to.*

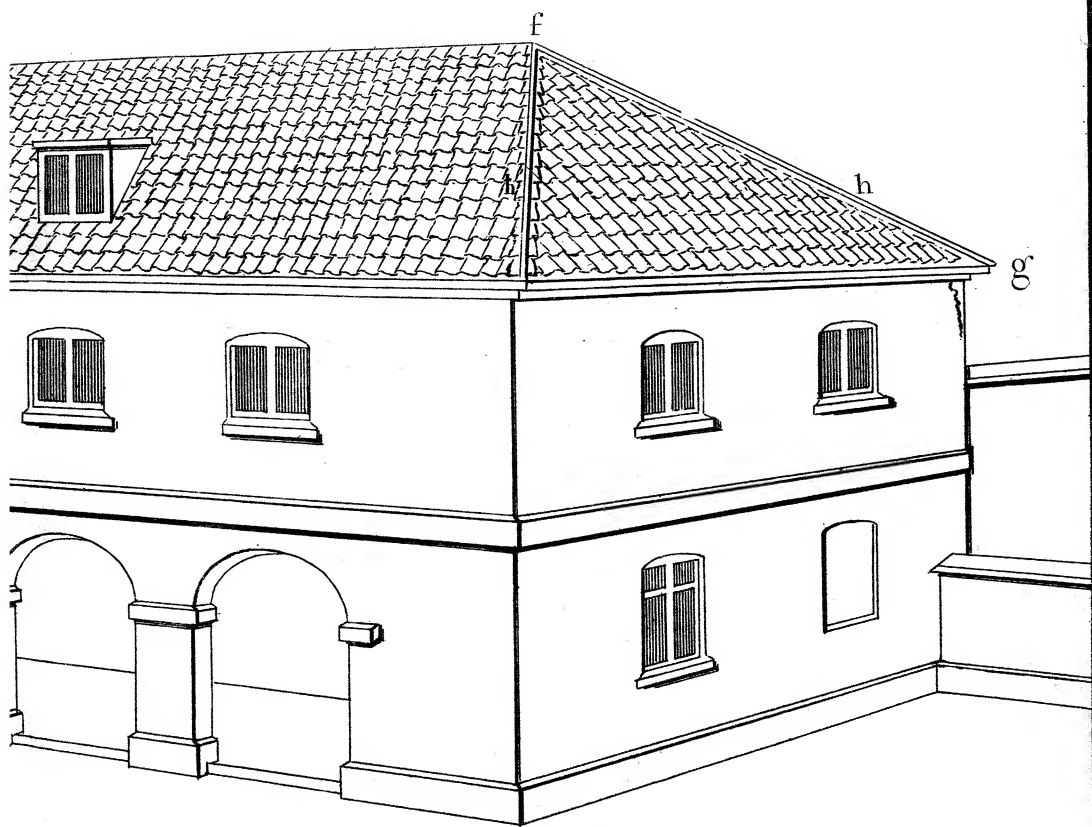
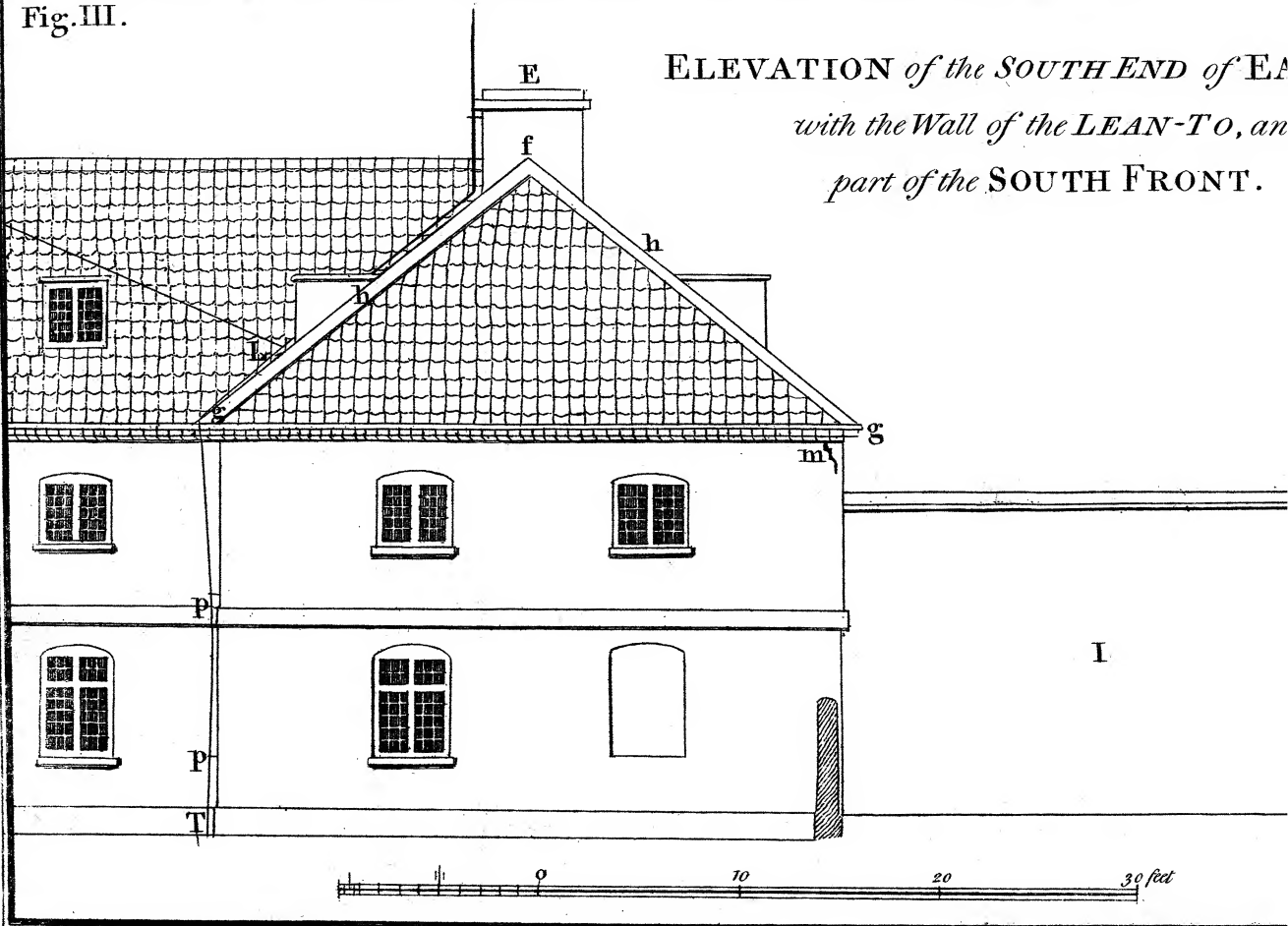


Fig. III.

ELEVATION of the SOUTH END of EA
with the Wall of the LEAN-TO, and
part of the SOUTH FRONT.



of EAST WING,
TO, and
NT.

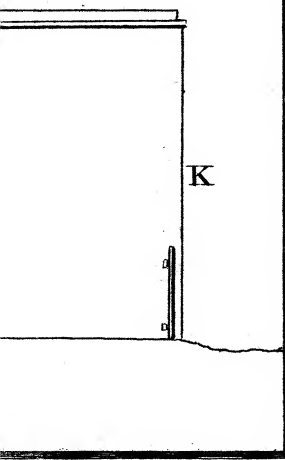
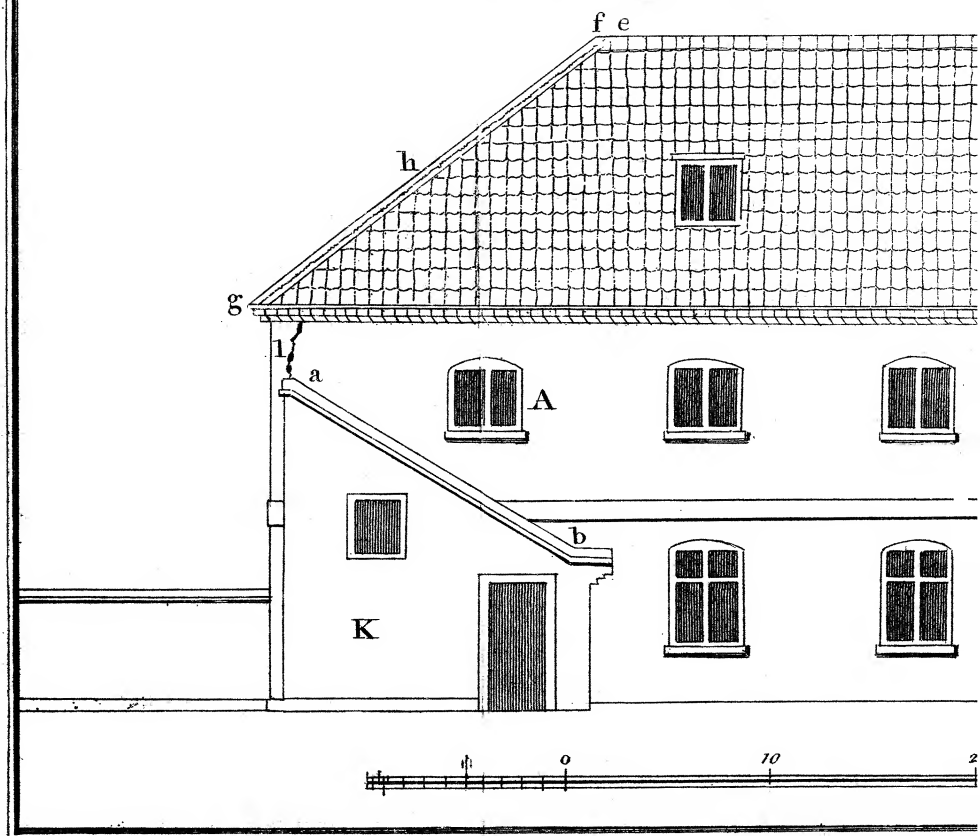
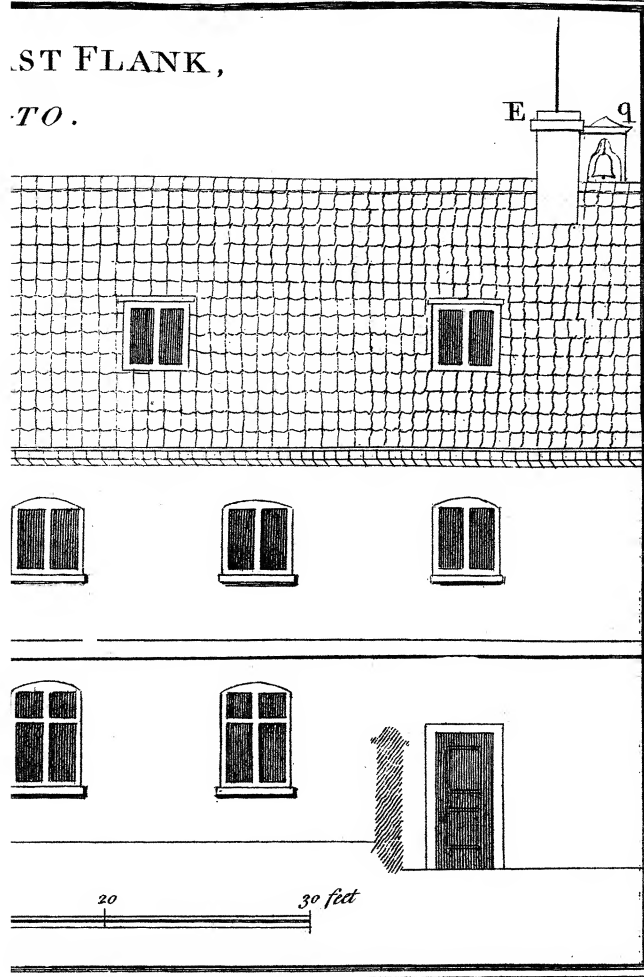


Fig.IV.

ELEVATION of part of the EAST F
with the adjoining LEAN-TO.



ST FLANK,
TO.



Before.

It may be proper, however, to add the two following pieces of information.

One of the cripples in the House of Industry, a middle-aged woman, assured us, that at the time of the accident, as she was looking from the door of the hall (which is in the center of the front facing the south), she saw three balls of fire dart down; that one fell exactly opposite her; a second seemed to strike the corner of the house; and the other descended in the direction of a door in the eastern flank, which was not far out of the perpendicular line of the chimney E (see the general plan, fig. 1.). If any credit could be given to the testimony of such a person in a matter like this, it would incline us to believe, that the explosion was made in three streams, of which one passed through the conductor of the chimney E, and another through the damaged corner of the house; whilst the third fell on the ground, or, as the woman described it, on the great gate of the fore court near the lodges (see the general plan, fig. 1.). We examined the gate and lodges, with the adjacent parts, but could nowhere discover any marks of injury; nor could we learn that any place in the neighbourhood had been struck, or that any person, except this woman, pretended to have seen the course of the lightning.

In our return to town, through Norwich, we saw an ingenious gentleman of that city, who says, that he found the clouds negative there on the day of the accident at Heckingham. The two places are distant about eleven miles by the road.

It would be unpardonable to conclude this Report, without expressing our obligations to the Directors and Guardians of the House of Industry at large, and to the neighbouring

Gentlemen in particular, for the liberal manner in which they seconded our endeavours to execute the commission with which you had charged us. By their kind assistance proper workmen were provided; and every accommodation afforded us, that could contribute to the investigation of this remarkable accident.

We have the honour to be,

GENTLEMEN,

Your most obedient humble servants,

C. BLAGDEN.

EDW. NAIRNE.

London, Feb. 7, 1782.

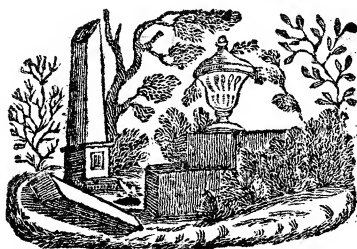
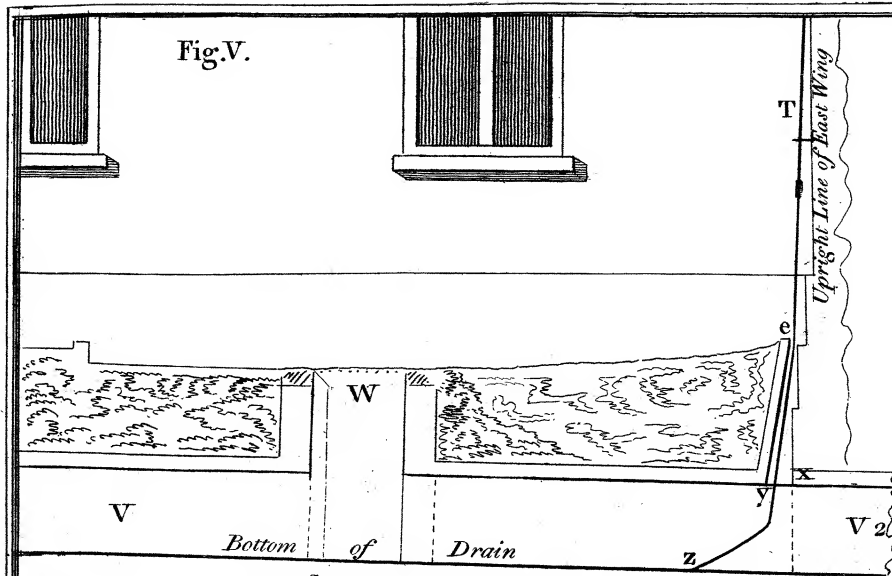


Fig.V.



SECTION

SECTIONS and PLAN of the
of the Conductor at the South
of the BUILDING



Line of South Front

Fig.VI.

PLAN

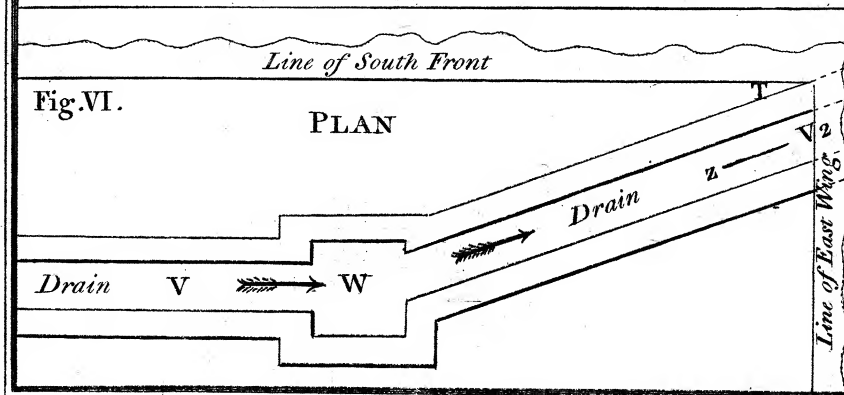
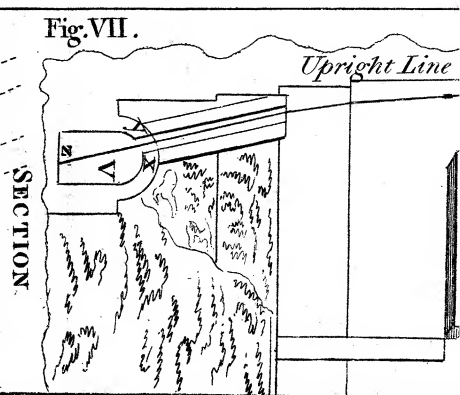


Fig.VII.



SECTION

Upright Line

Line of East Wing

AN of the termination
the South-East Angle
ILDING.

5 feet

ht Line of South Front

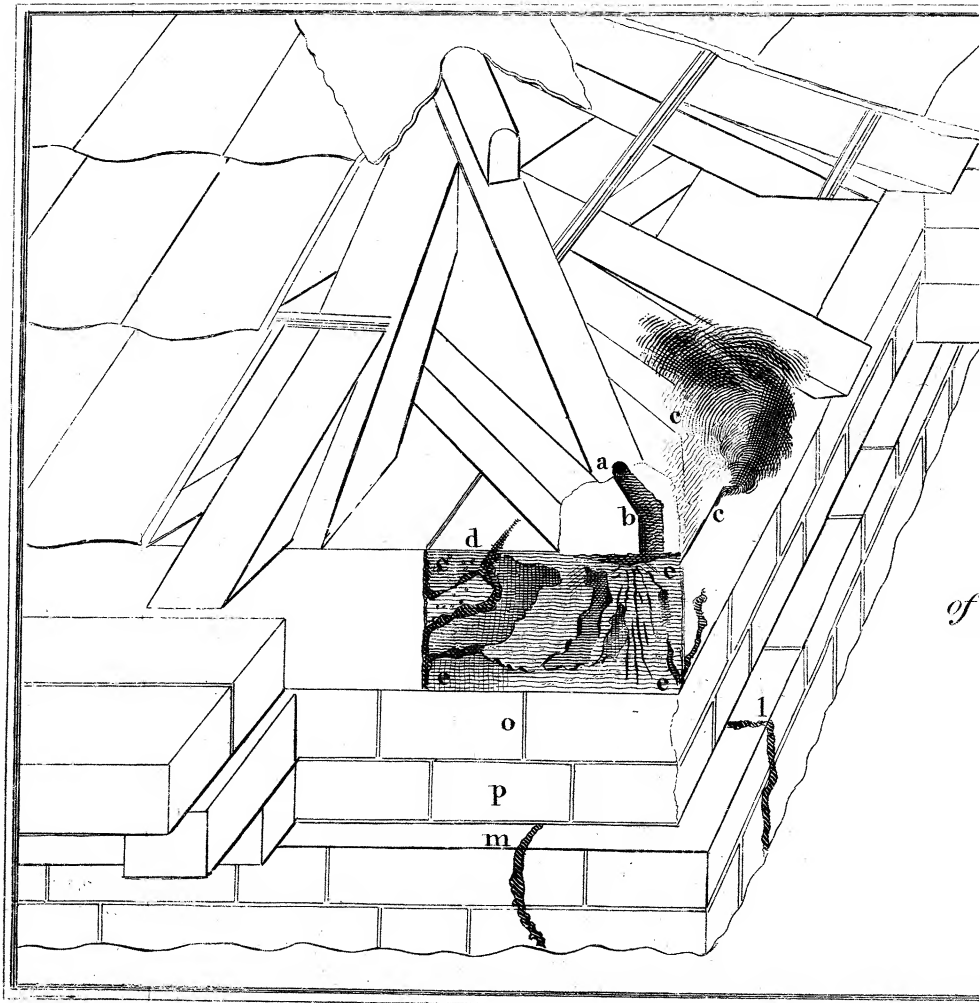
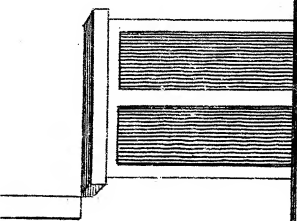
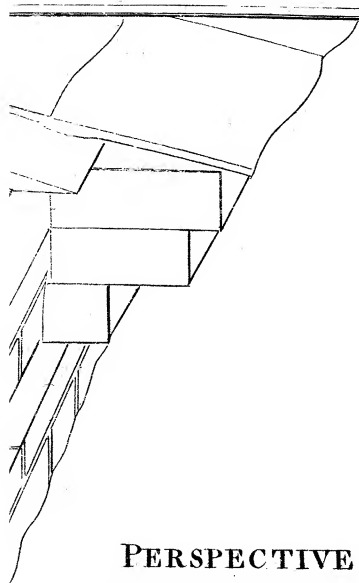


Fig. VIII.



PERSPECTIVE VIEW
*of the End of the Wall Plate and
part of the Rafters .*

W. G. S.

Fig. XII.

*FULL SIZE of the CONDUCTORS,
shewing the manner of their being jointed.*

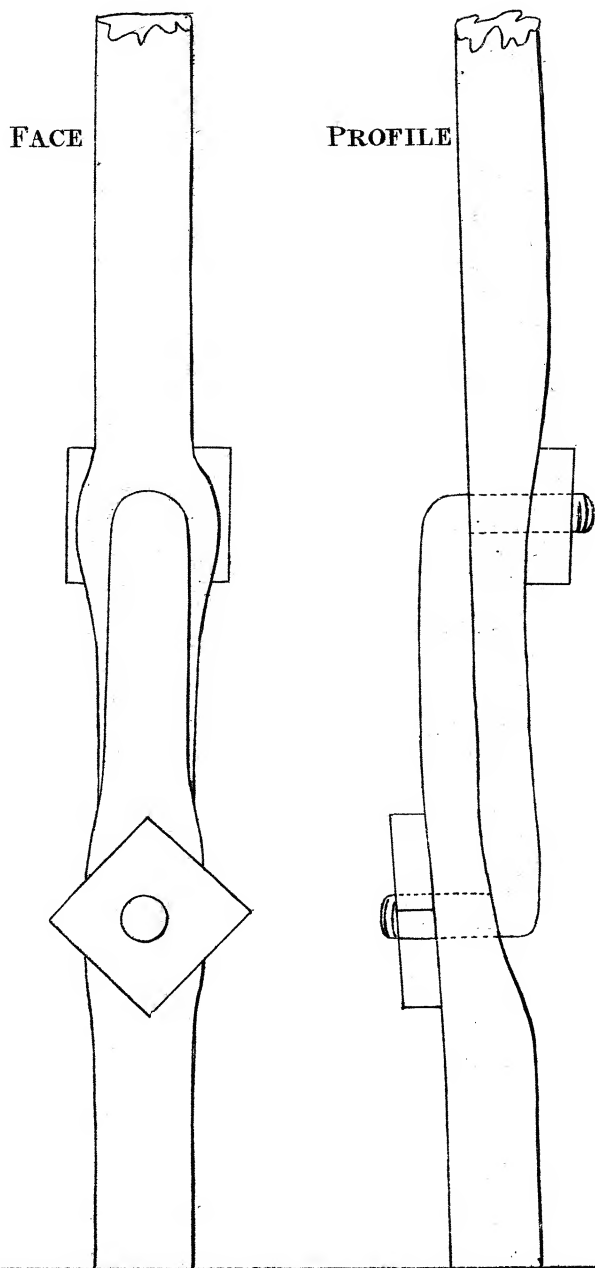
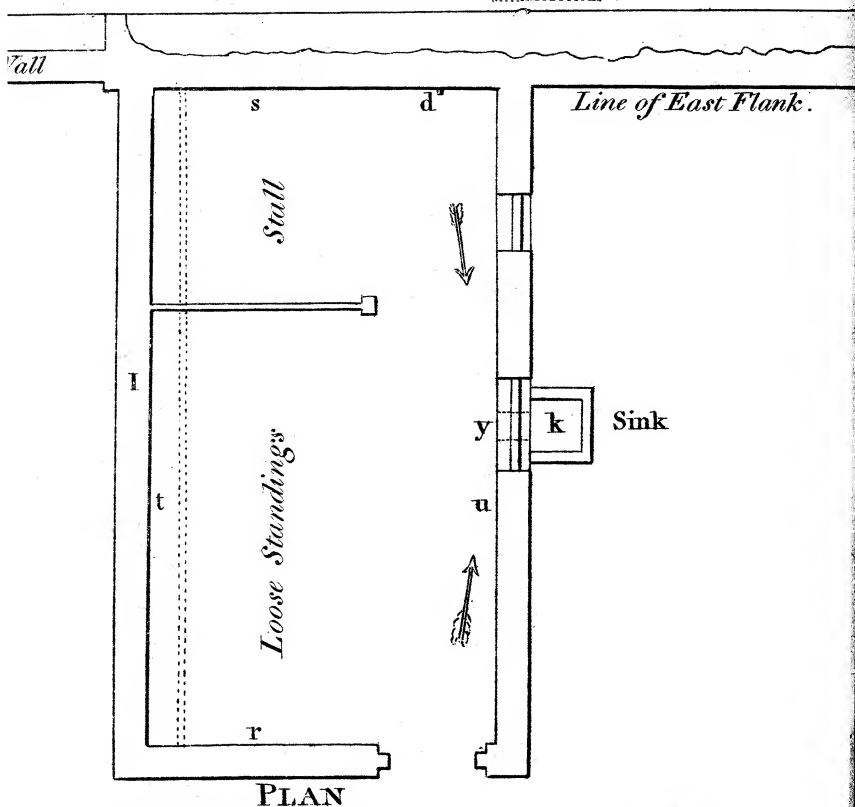
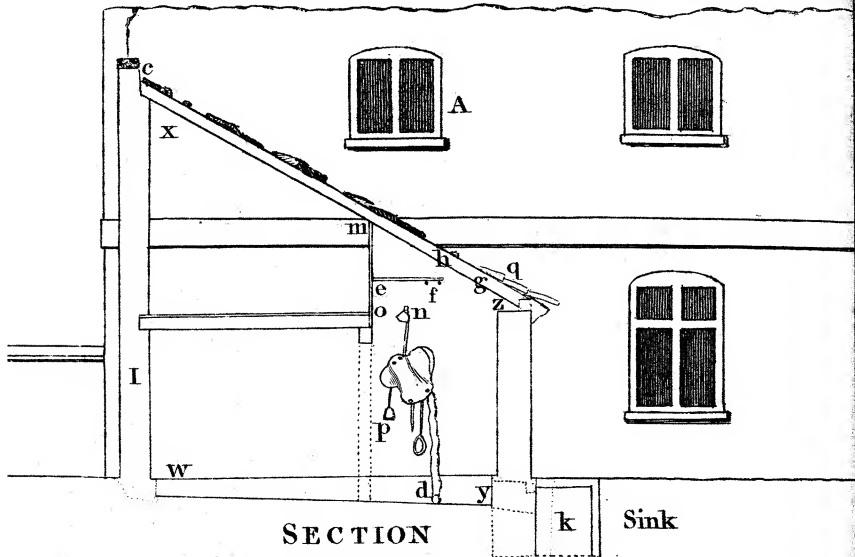


Fig. X.

Fence Wall

Fig. IX.

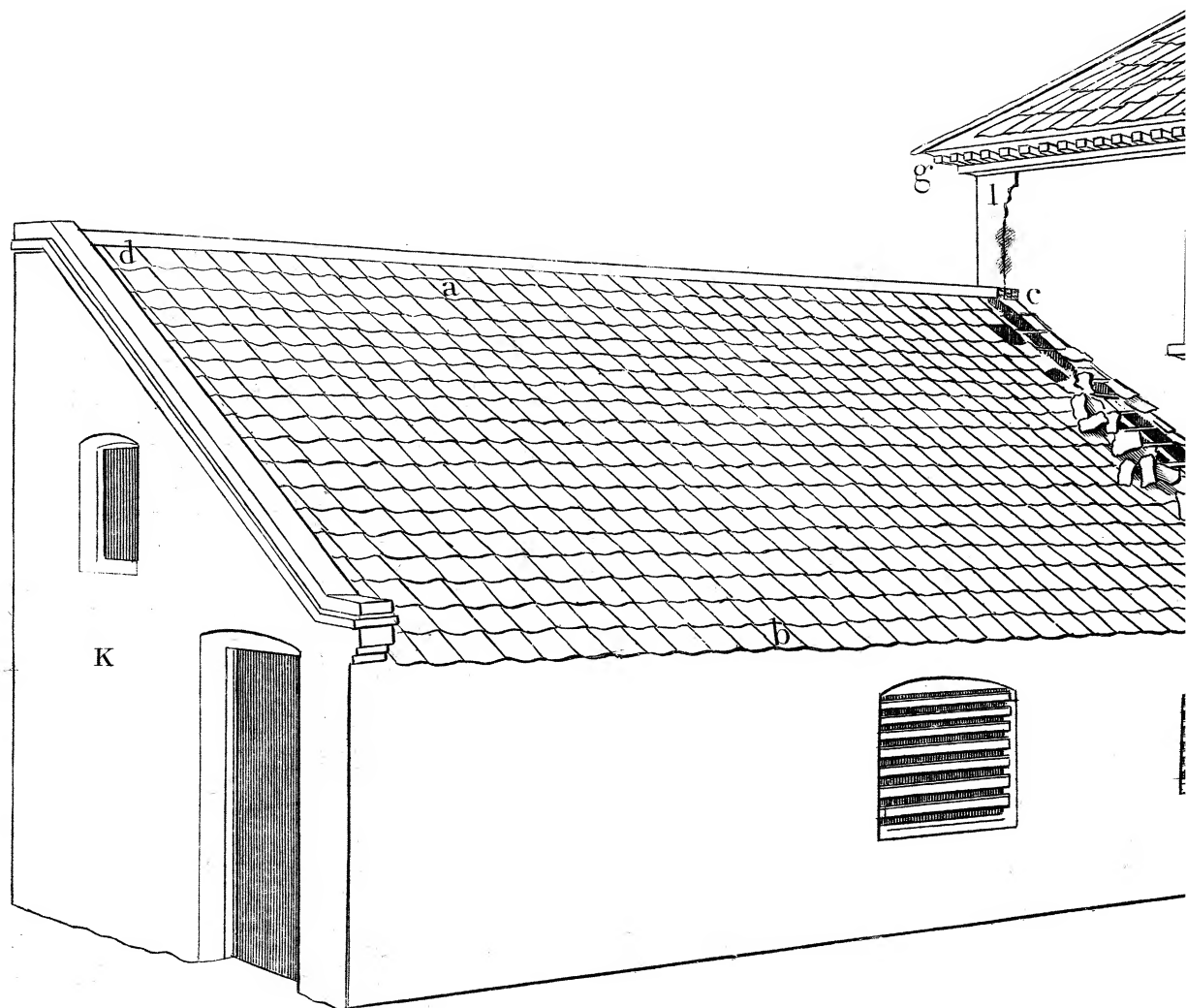
PLAN and SECTION of the Stable Lean-to.

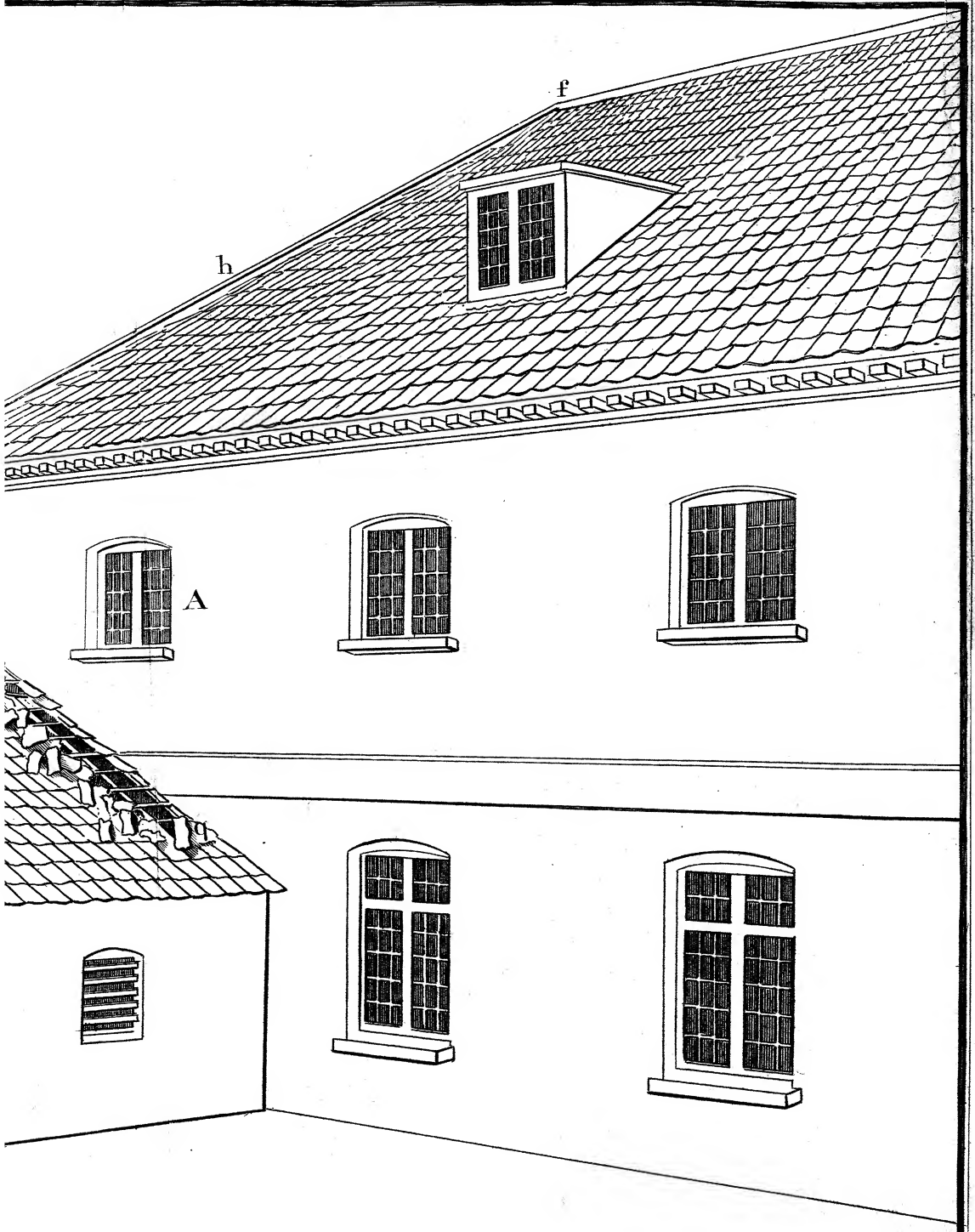


10 9 8 7 6 5 4 3 2 1 0 10 feet.

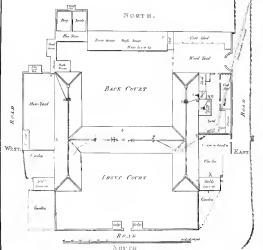
Fig.XI.

*NORTH-EAST VIEW of the STABLE LEAN-To
and part of the EAST FLANK.*





GENERAL PLAN







PERSPECTIVE VIEW
of the East of the West Gate and
part of the Highgate

SECTION and PLAN of the structure
of the wall and the building
of the Highgate



PLAN
of the structure of the wall and
the building of the Highgate



Fig. 10.

Full view of the chimney pipe, showing the nature of the long joint.

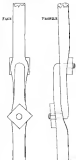


Fig. 11.

Plan and section of the main pipe in

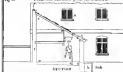


Fig. 12.

Plan of Main Pipe

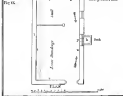


Fig. 51.

*NORTH-EAST VIEW of the STOREHOUSE
and part of the EAST RANGE*

